

Training and Evaluation Outline Report

Task Number: 05-3-5114

Task Title: Conduct Construction Drainage Operations

Supporting Reference(s):

Step Number	Reference ID	Reference Name	Required	Primary
	FM 5-19	COMPOSITE RISK MANAGEMENT	Yes	No
	FM 5-412	PROJECT MANAGEMENT	Yes	No
	FM 5-430-00-1	PLANNING AND DESIGN OF ROADS, AIRFIELDS, AND HELIPORTS IN THE THEATER OF OPERATIONS - ROAD DESIGN	Yes	Yes
	FM 5-430-00-2	PLANNING AND DESIGN OF ROADS, AIRFIELDS, AND HELIPORTS IN THE THEATER OF OPERATIONS - AIRFIELD AND HELIPORT DESIGN	Yes	No
	FM 5-434	EARTHMOVING OPERATIONS	Yes	No
	STP 5-62E12-SM-TG	MOS 62E, Heavy Construction Equipment Operator Skill Levels 12, Soldier's Manual and Trainer's Guide	Yes	No
	TM 5-704	Construction Print Reading in the Field. AFM 85-27.	Yes	No

Condition: The element receives an operation order (OPORD) with a directive to provide construction site drainage for a construction project. Equipment and materials are available. Plans and specifications, to include the bill of materials (BOM), are provided. Some iterations of this task should be performed in MOPP.

Standard: The element conducts construction drainage operations, ensuring that drainage structures are completed no later than the time specified. The drainage system effectively removes surface and subsurface water from the vicinity of the facility and the adjacent areas. Installation of culverts will be done by a vertical construction element. The time required to perform this task is increased when conducting it in mission-oriented protective posture (MOPP) 4.

Special Equipment: None

Task Statements

Cue: None

DANGER

N/A

WARNING

N/A

CAUTION

None

Remarks: None

Notes: None

TASK STEPS

- * 1. The element leader conducts troop-leading procedures.
- 2. The element establishes jobsite security.
- * 3. The element leader determines the size, construction, location, and peak volume of storm water runoff of the drainage ditch.
 - a. Determines the ditch type.
 - (1) Uses a trapezoidal ditch for peak runoff (Q) greater than 60 cubic feet per second.
 - (2) Uses a triangular ditch for peak runoff (Q) equal to or less than 60 cubic feet per second.
 - b. Constructs temporary ditches to collect and diverts surface runoff before construction.
 - c. Constructs interceptor and roadside ditches.
 - (1) Places interceptor ditches on the hillside above the roadway, ensuring that they have a slope of 1:1.
 - (2) Constructs an interceptor ditch as a part of the final drainage system.
 - (3) Places a roadside ditch, ensuring that the adjacent slope is 3:1 or greater.
 - (4) Ensures that the roadside ditch collects runoff from the road and the adjacent area and transports it to a culvert or diversion ditch.
 - d. Determines the longitudinal slope. If the slope is a percentage, converts it to units of feet per foot by dividing by 100.
 - e. Uses rocks or rubble to slow water velocity if the longitudinal slope exceeded 2 percent.
 - f. Selects trial values for resistance and velocity.
 - (1) Selects the average value of resistance or roughness coefficient and velocity for the soil type.
 - (2) Holds the initial trial velocity to 1 foot per second below the design flow.
 - g. Determines the type of ditch cross section.
 - (1) Uses a trapezoidal ditch for quantities greater than 60 cubic feet per second.
 - (2) Uses a triangular ditch for quantities equal to or less than 60 cubic feet per second.
 - h. Selects the appropriate hydraulic radius and area table.
 - (1) Identifies the column headed with the tentative side slope ratios, enters the table with Rm (hydraulic radius, nomograph value), and locates the value of Rt (hydraulic radius, table value) that corresponded with Rm.
 - (2) Finds the cross-sectional area and ditch depth that corresponds with Rm and Rt.
 - (3) Uses the next smaller Rt value if the exact Rm value was not available.

i. Calculates the quantity.

(1) Uses a triangular ditch if the quantity of flow was within 6 percent.

(2) Uses a trapezoidal ditch if the quantity of flow was more than 6 percent.

(3) Uses erosion control if the velocity exceeded the maximum of the soil content.

(4) Reduces the slope of the culvert.

(5) Lines the bottom and sides of the channel with rocks or rubble to prevent erosion.

j. Submits a requests for changes to improve or correct construction plans and specifications, as needed.

4. The element prepares the culvert site for construction.

a. Selects a culvert location.

b. Constructs the culvert perpendicular to the road centerline where no drainage channel existed.

c. Constructs the culvert invert elevation on or below the stream bed.

d. Ensures that the culvert slope is between 0.5 and 2 percent.

5. The element prepares a culvert trench.

a. Ensures that the culvert trench has the proper 0.5 to 2 percent slope and is deep enough for the bed, culvert, and cover.

b. Ensures that the depth of the culvert bed is one-tenth of the culvert diameter.

c. Ensures that the cover is one-half the diameter of the culvert or 30.5 centimeters.

d. Ensures that the trench width provided for the culvert diameter, side spacing, and multiple culverts, if used.

e. Installs shoring before emplacing the culvert, only if required.

6. The element constructs head walls.

a. Constructs an upstream head wall, using sandbags filled with a soil and cement mixture.

b. Constructs a downstream head wall, if time permitted.

c. Extends the corrugated metal pipe (CMP) a minimum of 61 centimeters beyond the toe of the slope if no downstream head wall was constructed.

7. The element constructs permanent ditches according to calculations from task step 4.

8. The element provides erosion control.

a. Installs rip rap by hand, and compacts at least two layers in the ditch bottom and on the sides.

- (1) Extends timber at least 61 centimeters into the bottom and sides of the ditch.
- (2) Places rip rap or rubble at least 1.2 meters from the facing on the discharge side.
- (3) Ensures that spacing was at no less than 15.3-meter intervals.

(Asterisks indicates a leader performance step.)

PERFORMANCE MEASURES	GO	NO-GO	N/A
1. Conducted troop-leading procedures			
2. Established jobsite security			
3. Calculated drainage requirements			
4. Prepared the culvert site for construction			
5. Emplaced the culvert			
a. Selected a culvert location			
b. Dug trench with a slope between 0.5 and 2 percent			
c. Ensured that the depth of the culvert bed is one-tenth of the culvert diameter			
d. Ensured that the cover is one-half the diameter of the culvert or 30.5 centimeters			
e. Installed shoring before emplacing the culvert, as required			
6. Constructed head walls			
7. Constructed permanent ditches according to drainage calculations			
8. Employed erosion control techniques			
9. Submitted status reports to higher headquarters (HQ) according to the unit standing operating procedure (SOP)			

TASK PERFORMANCE / EVALUATION SUMMARY BLOCK							
ITERATION	1	2	3	4	5	M	TOTAL
TOTAL PERFORMANCE MEASURES EVALUATED							
TOTAL PERFORMANCE MEASURES GO							
TRAINING STATUS GO/NO-GO							

Prerequisite Collective Task(s):

Step Number	Task Number	Title	Proponent	Status
	05-3-3006	Establish Jobsite Security	05 - Engineers (Collective)	Approved
	07-2-5081	Conduct Troop-leading Procedures (Platoon-Company)	07 - Infantry (Collective)	Obsolete

Supporting Collective Task(s):

Step Number	Task Number	Title	Proponent	Status
	05-3-5106	Install a Culvert	05 - Engineers (Collective)	Approved
	07-2-5081	Conduct Troop-leading Procedures (Platoon-Company)	07 - Infantry (Collective)	Obsolete

Supporting Individual Task(s):

Step Number	Task Number	Title	Proponent	Status
	052-210-1005	Manage Projects Using TCMS and MS Project	052 - Engineer (Individual)	Approved
	052-210-1016	Manage the Installation of Culverts	052 - Engineer (Individual)	Approved
	052-210-1216	Manage the Layout of Construction Project Survey Stakes and Markers	052 - Engineer (Individual)	Approved
	052-210-1218	Manage Soil Sample Representative Procedures	052 - Engineer (Individual)	Approved
	052-210-1222	Manage Preliminary Site Survey (Topographical/Radial Survey)	052 - Engineer (Individual)	Approved
	052-210-1223	Establish Temporary Control Points	052 - Engineer (Individual)	Approved
	052-210-1224	Manage Balance Earthwork Volumes	052 - Engineer (Individual)	Approved
	052-210-1225	Manage a Soils Exploration	052 - Engineer (Individual)	Approved
	052-210-1226	Develop a Soil Profile	052 - Engineer (Individual)	Approved
	052-210-1237	Prepare a Preliminary Construction Site Analysis	052 - Engineer (Individual)	Approved
	052-210-1241	Direct Drainage Operations	052 - Engineer (Individual)	Approved
	052-210-9999	Inspect Survey Layouts	052 - Engineer (Individual)	Approved
	052-243-1250	Determine Grain Size Distribution by Hydrometer Analysis	052 - Engineer (Individual)	Analysis
	052-243-1250	Determine Grain Size Distribution by Hydrometer Analysis	052 - Engineer (Individual)	Approved
	052-243-1506	Classify a Soil Using the Unified Soil Classification System	052 - Engineer (Individual)	Analysis
	052-243-1506	Classify a Soil Using the Unified Soil Classification System	052 - Engineer (Individual)	Approved
	052-243-1510	Perform a Preliminary Site Survey (Topographical/Radial Survey)	052 - Engineer (Individual)	Approved
	052-243-1512	Establish Temporary Control Points	052 - Engineer (Individual)	Approved
	052-243-1513	Perform Layout of a Construction Project	052 - Engineer (Individual)	Approved
	052-253-1206	Backfill an Area Using a Small-Emplacement Excavator (SEE)	052 - Engineer (Individual)	Approved
	052-254-1037	Construct a Ditch With a Crawler Tractor	052 - Engineer (Individual)	Approved
	052-254-1042	Level Fill Material in a Fill Area With the Angle Blade of a Crawler Tractor	052 - Engineer (Individual)	Approved
	052-254-1052	Construct a V Ditch With a Motorized Grader	052 - Engineer (Individual)	Approved
	052-254-2045	Finish Slopes With a Motorized Grader	052 - Engineer (Individual)	Approved
	052-256-3020	Interpret a Construction Print	052 - Engineer (Individual)	Approved
	052-256-3042	Direct Drainage Operations	052 - Engineer (Individual)	Approved
	052-256-3043	Direct Crawler Tractor Operations	052 - Engineer (Individual)	Approved
	052-256-3045	Direct Motor Grader Operations	052 - Engineer (Individual)	Approved
	052-256-3048	Direct Utility Tractor Operations	052 - Engineer (Individual)	Approved
	052-256-4143	Schedule Work in a Construction Project	052 - Engineer (Individual)	Approved
	052-256-4151	Supervise the Construction of a Road	052 - Engineer (Individual)	Approved
	052-302-7106	Direct Installation of Theater of Operations (T/O) Plumbing Systems / Fixtures	052 - Engineer (Individual)	Approved
	052-306-7101	Direct Construction Site Reconnaissance	052 - Engineer (Individual)	Approved
	052-306-7106	Interpret Construction Documents	052 - Engineer (Individual)	Approved

Supporting Drill Task(s): None

TADSS

Step ID	TADSS ID	Title	Product Type	Quantity
No TADSS specified				

Equipment (LIN)

Step ID	LIN	Nomenclature	Qty
No equipment specified			

Materiel Items (NSN)

Step ID	NSN	LIN	Title	Qty
No equipment specified				

Environment: Environmental protection is not just the law but the right thing to do. It is a continual process and starts with deliberate planning. Always be alert to ways to protect our environment during training and missions. In doing so, you will contribute to the sustainment of our training resources while protecting people and the environment from harmful effects. Refer to FM 3-34.5 Environmental Considerations and GTA 05-08-002 ENVIRONMENTAL-RELATED RISK ASSESSMENT

Safety: In a training environment, leaders must perform a risk assessment in accordance with FM 5-19, Composite Risk Management. Leaders will complete a DA Form 7566 COMPOSITE RISK MANAGEMENT WORKSHEET during the planning and completion of each task and sub-task by assessing mission, enemy, terrain and weather, troops and support available-time available and civil considerations, (METT-TC). Note: During MOPP training, leaders must ensure personnel are monitored for potential heat injury. Local policies and procedures must be followed during times of increased heat category in order to avoid heat related injury. Consider the MOPP work/rest cycles and water replacement guidelines IAW FM 3-11.4, NBC Protection, FM 3-11.5, CBRN Decontamination. In a training environment, leaders must perform a risk assessment in accordance with FM 5-19, Composite Risk Management. Leaders will complete a DA Form 7566 COMPOSITE RISK MANAGEMENT WORKSHEET during the planning and completion of each task and sub-task by assessing mission, enemy, terrain and weather, troops and support available, time available, and civil considerations (METT-TC). Note: During MOPP training, leaders must ensure personnel are monitored for potential heat injury. Local policies and procedures must be followed during times of increased heat category in order to avoid heat related injury. Consider the MOPP work/rest cycles and water replacement guidelines IAW FM 3-11.4, NBC Protection, FM 3-11.5, CBRN Decontamination.